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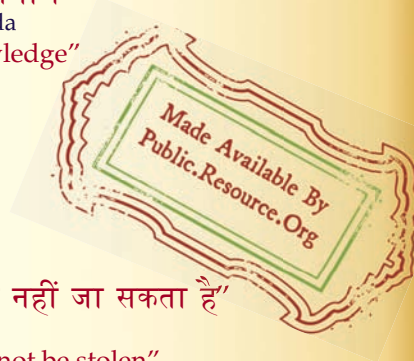
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Indian Standard

RECOMMENDATION FOR
OPERATING REQUIREMENT FOR POWER
TAKE-OFF DRIVEN IMPLEMENTS

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

RECOMMENDATION FOR OPERATING REQUIREMENT FOR POWER TAKE-OFF DRIVEN IMPLEMENTS

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Indian Standard

RECOMMENDATION FOR OPERATING REQUIREMENT FOR POWER TAKE-OFF DRIVEN IMPLEMENTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 November 1983, after the draft finalized by the Agricultural Tractors and Power Tillers Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Operating requirement for tractor's power take-off (PTO) driven implements was covered in IS : 4971-1977*. While revising this standard it was felt that operating requirement should be separated and updated on the basis of the corresponding SAE recommendation and published as a separate Indian Standard.

0.3 In preparation of this standard, assistance has been derived from SAE J 721-1980 'Operating requirements for tractors and power take-off driven implements' published by Society of Automotive Engineers, USA.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers recommended practice to assist manufacturers of tractors and implements in providing suitable means of transmitting power from the tractor power take-off to the implements and satisfactory hitching of the implements to the tractors.

2. DEFINITIONS

2.0 For the purpose of this standard, the following definitions shall apply.

*Specification for power take-off shaft of agricultural tractors (*first revision*).

†Rules for rounding off numerical values (*revised*).

2.1 Power Take-Off (PTO) — A shaft usually externally splined, to transmit torsional power to another machine.

2.2 Implement Drive Line (IDL) — The shafts, universal joints, connectors and fasteners provided with the implements to transmit rotational power from tractor PTO to the first component, on the implement, such as a gear set, pulley, sprocket or fly wheel.

3. INSTRUCTIONS FOR THE OPERATOR

3.1 The implement manufacturer shall provide a sign in a prominent place on the implement specifying the required tractor drawbar hitch point location and/or implement hitch adjustments.

3.2 The implement operator's manual shall also include the information given under 3.1.

3.3 If a conversion assembly is made available for changing tractors or implements from 540 to 1 000 rev/min or from 1 000 to 540 rev/min, these conversion assemblies shall include a sign specifying the power take-off speed and the corresponding drawbar adjustments.

4. IMPLEMENT DRIVE LINE (IDL) AND HITCH REQUIREMENTS

4.1 Provision should be made in the IDL and the hitch of the implements to prevent any of the following from occurring during normal operation when attached and operated according to the instructions of the implement manufacturer, to any tractor PTO which conforms to IS : 4931-1977*.

- a) The universal joints in the IDL from reaching a locking angle;
- b) The telescopic section of the implement drive line from separating beyond the point where there is sufficient bearing to provide for proper operation;
- c) The IDL from sustaining damage from telescoping to a solid position; and
- d) The IDL or its shields from sustaining damage due to contacting the implement hitch or hitch pin, or any tractor parts, such as master shield or three point hitch linkage.

4.2 Vertical Loads on Drawbars — The minimum vertical static loads which the tractor drawbar shall withstand are given in Table 1.

4.2.1 The maximum vertical static loads which the implement shall impose upon the tractor drawbar would be the same as given in col 3 of Table 1. The dynamic loads imposed upon the tractor drawbar and implement hitch shall be considerably higher than static load ratings.

4.2.2 The use of a hitch extender shall require a reduction in the vertical static loads to limit the maximum bending moment in the tractor drawbar to that allowed under 4.2 and Table 1.

*Specification for power take-off shaft for agricultural tractors (*first revision*).

TABLE 1 VERTICAL STATIC LOADS ON DRAWBARS
(Clause 4.2)

SL No.	MAX POWER, kW	DRAWBAR LOAD, kN
(1)	(2)	(3)
i)	14.9 to 74.6	$3.34 + 0.15$ per kW for excess over 14.9 kW
ii)	74.6 to 186.4	$12.23 + 0.06$ per kW for excess over 74.6 kW
iii)	186.4 to 372.5	$18.90 + 0.03$ per kW for excess over 186.4 kW

NOTE — Maximum power means maximum drawbar power established by conducting the test in accordance with IS : 5994 (Part 2)-1979 Test code for agricultural tractors : Part 2 Laboratory and track tests (first revision).

5. MAXIMUM BENDING LOAD LIMITATIONS FOR POWER TAKE-OFF DRIVES EMPLOYING V-BELTS OR CHAINS

5.1 The PTO shaft of tractors is designed primarily to transmit torsional loads. The total bending load imposed on the tractor PTO shaft by V-belts or chain drives should not be in excess of the values shown in Table 2.

TABLE 2 MAXIMUM BENDING LOAD

SL No.	POSITION OF LOAD APPLICATION	MAXIMUM BENDING LOAD IN kN	
		For 35 mm Diameter PTO	For 45 mm Diameter PTO
(1)	(2)	(3)	(4)
i)	At the end of PTO shaft	2.22	3.56
ii)	Between the PTO shaft rear bearing and/or at the groove in the outside diameter of the PTO shaft splines	2.67	4.45

5.2 The tractor PTO shaft and bearing mountings should successfully withstand the magnitude of bending load given in Table 2.

6. TORSIONAL LOAD CONSIDERATIONS

6.1 Because of the large amount of kinetic energy available at the PTO shaft, instantaneous torsional loads and fluctuating operating loads in excess of the average rated power of the tractor may be transmitted.

7. PTO SHAFT AND IDL THRUST LOAD LIMITATIONS

7.1 The tractor PTO shall be designed to accept IDL telescoping thrust force values given in Table 3 based on PTO power at rated engine speed as established by conducting the test in accordance with IS : 5994 (Part 2)-1979*. A properly maintained implement at its designed power shall not impose IDL telescoping thrust forces upon the tractor PTO in excess of the values given in Table 3 recognizing that instantaneous thrust forces may exceed these values.

TABLE 3 PTO THRUST FORCES

PTO SIZE, mm	PTO POWER, kW	THRUST, kN
(1)	(2)	(3)
35	15 to 25	7.00
	over 25 to 40	9.00
	over 40 to 60	11.00
	over 60 to 110	13.00
	over 110	14.00
45	over 110	18.00

8. SAFETY CONSIDERATIONS

8.1 The tractor shall be equipped with a PTO shield when provided with a PTO shaft in accordance with IS : 4931-1977†.

8.2 Provisions shall be made on the tractor to shield the auxiliary PTO when it is connected to one implement drive line.

8.3 Shields or other protective means shall be provided on the tractor for the PTO and auxiliary PTO when they are not connected to an implement drive line.

8.4 PTO driven implements shall be equipped with shielding for the implement drive line.

8.5 PTO driven implements that require removal of the tractor master guard shall include comparable shielding.

8.6 A safety sign(s) shall be provided at a prominent location on the implement and tractor specifying the normal PTO operating speed and that implement drive line shields and PTO shield are to be kept in place.

8.7 PTO driven implements designed to operate in a stationary position, should be provided with a means to maintain the implement to tractor spacing to prevent separation of the power drive line.

*Test code for agricultural tractors: Part 2 Laboratory and track tests (first revision).

†Specification for power take-off shaft for agricultural tractor (first revision).